

University of Wollongong Research Online

Faculty of Social Sciences - Papers

Faculty of Arts, Social Sciences & Humanities

2013

The nutrition and enjoyable activity for teen girls study: A cluster randomized controlled trial

Deborah L. Dewar
University of Newcastle

Philip J. Morgan
University of Newcastle

Ronald C. Plotnikoff
University of Newcastle

Anthony D. Okely
University of Wollongong, tokely@uow.edu.au

Clare E. Collins
University of Newcastle

See next page for additional authors

Follow this and additional works at: <https://ro.uow.edu.au/sspapers>



Part of the [Education Commons](#), and the [Social and Behavioral Sciences Commons](#)

Recommended Citation

Dewar, Deborah L.; Morgan, Philip J.; Plotnikoff, Ronald C.; Okely, Anthony D.; Collins, Clare E.; Batterham, Marijka; Callister, Robin; and Lubans, David R., "The nutrition and enjoyable activity for teen girls study: A cluster randomized controlled trial" (2013). *Faculty of Social Sciences - Papers*. 325.
<https://ro.uow.edu.au/sspapers/325>

Research Online is the open access institutional repository for the University of Wollongong. For further information contact the UOW Library: research-pubs@uow.edu.au

The nutrition and enjoyable activity for teen girls study: A cluster randomized controlled trial

Abstract

Background Obesity prevention among youth of low SES is a public health priority given the higher prevalence of youth obesity in this population subgroup. **Purpose** To evaluate the 24-month impact of a school-based obesity prevention program among adolescent girls living in low-income communities. **Design** The study was a school-based group RCT, the Nutrition and Enjoyable Activity for Teen Girls (NEAT Girls) intervention. **Setting/participants** The study involved 12 secondary schools located in low-income communities in New South Wales, Australia. Participants were 357 adolescent girls (aged 13.2±0.5 years). **Intervention** The 12-month multicomponent intervention was guided by social cognitive theory and involved strategies to promote physical activity, reduce sedentary behaviors, and improve dietary outcomes. **Main outcome measures** The primary outcome was BMI, and secondary outcomes were BMI z-score; percentage body fat (bioelectrical impedance analysis); physical activity (accelerometers); dietary intake; and recreational screen-time (self-report). Data were collected in 2010–2012 and analyzed in 2012. **Results** After 24 months, there were no intervention effects on BMI (adjusted mean difference -0.33, 95% CI= -0.97, 0.28, p=0.353) and BMI z-score (-0.12, 95% CI= -0.27, 0.04, p=0.178). However, there was a group-by-time interaction for percentage body fat (-1.96%, 95% CI= -3.02, -0.89, p=0.006). Intervention effects for physical activity, screen time, and dietary intake were not significant. **Conclusions** The NEAT Girls intervention did not result in effects on the primary outcome. Further study of youth who are “at risk” of obesity should focus on strategies to improve retention and adherence in prevention programs.

Keywords

era2015

Disciplines

Education | Social and Behavioral Sciences

Publication Details

Dewar, D. L., Morgan, P. J., Plotnikoff, R. C., Okely, A. D., Collins, C. E., Batterham, M., Callister, R. & Lubans, D. R. (2013). The nutrition and enjoyable activity for teen girls study: A cluster randomized controlled trial. *American Journal of Preventive Medicine*, 45 (3), 313-317.

Authors

Deborah L. Dewar, Philip J. Morgan, Ronald C. Plotnikoff, Anthony D. Okely, Clare E. Collins, Marijka Batterham, Robin Callister, and David R. Lubans

Two-Year Outcomes from the NEAT Girls Obesity Prevention Cluster Randomized Controlled Trial

Deborah L. Dewar, BEd¹, Philip J. Morgan, PhD¹, Ronald C. Plotnikoff, PhD¹, Anthony D. Okely, EdD², Clare E. Collins, PhD³, Marijka Batterham, PhD⁴, Robin Callister, PhD⁵ and David R. Lubans, PhD^{1§},

¹Priority Research Centre in Physical Activity and Nutrition, School of Education, University of Newcastle, Newcastle, Callaghan Campus, Australia

²Interdisciplinary Educational Research Institute, University of Wollongong, Wollongong, Australia

³Priority Research Centre in Physical Activity and Nutrition, School of Health Sciences, University of Newcastle, Newcastle, Callaghan Campus, Australia

⁴Centre for Statistical and Survey Methodology, University of Wollongong, Wollongong, Australia

⁵Priority Research Centre in Physical Activity and Nutrition, School of Biomedical Sciences and Pharmacy, University of Newcastle, Newcastle, Callaghan Campus, Australia

§Corresponding author

Associate Professor David Lubans
School of Education
Faculty of Education and Arts
University of Newcastle
Callaghan NSW Australia 2308
+ 61 2 4921 2049 (Phone)
+ 61 2 4921 7407 (Fax)
David.Lubans@newcastle.edu.au

Word Count (text only): 1231

Number of pages: 17 (including table and figures)

Number of tables: 1

Number of figures: 1

Conflict of interest statement:

This research project is funded by an Australian Research Council Discovery Project Grant (DP1092646). All authors have no conflicts of interest to disclose.

Deborah L. Dewar: is supported by an Australian Post Graduate Award scholarship. Institutional affiliations include the Priority Research Centre in Physical Activity and Nutrition, School of Education, University of Newcastle, Newcastle, Callaghan Campus, Australia

Philip J. Morgan: Institutional affiliations include the Priority Research Centre in Physical Activity and Nutrition, School of Education, University of Newcastle, Newcastle, Callaghan Campus, Australia

Ronald C. Plotnikoff: Institutional affiliations include the Priority Research Centre in Physical Activity and Nutrition, School of Education, University of Newcastle, Newcastle, Callaghan Campus, Australia

Anthony D. Okely: is supported by a National Heart Foundation of Australia Career Development Fellowship (CR11S 6099). Institutional affiliations include the Interdisciplinary Educational Research Institute, University of Wollongong, Wollongong, Australia

Clare E. Collins: Priority Research Centre in Physical Activity and Nutrition, School of Health Sciences, University of Newcastle, Newcastle, Callaghan Campus, Australia

Marijka Batterham: Centre for Statistical and Survey Methodology, University of Wollongong, Wollongong, Australia

Robin Callister: Priority Research Centre in Physical Activity and Nutrition, School of Biomedical Sciences and Pharmacy, University of Newcastle, Newcastle, Callaghan Campus, Australia

David R. Lubans: Institutional affiliations include the Priority Research Centre in Physical Activity and Nutrition, School of Education, University of Newcastle, Newcastle, Callaghan Campus, Australia

ABSTRACT

Background: Obesity prevention among youth of low socio-economic position is a public health priority given the higher prevalence of youth obesity in this population sub-group.

Purpose: To evaluate the 24-month impact of a school-based obesity prevention program among adolescent girls living in low-income communities.

Methods: A school-based group randomized controlled trial that involved 12 secondary schools located in low-income communities in New South Wales, Australia. Participants were 357 adolescent girls (13.2 ± 0.5 years). The 12-month multi-component intervention was guided by Social Cognitive Theory and involved strategies to promote physical activity, reduce sedentary behaviors and improve dietary outcomes. The primary outcome was body mass index (BMI) and secondary outcomes were BMI z-score, percentage body fat (bioelectrical impedance analysis), physical activity (accelerometers), dietary intake and recreational screen-time (self-report). Data were collected in 2010-2012 and analyzed in 2012.

Results: After 24 months, the intervention effects on BMI (adjusted mean difference [95% CI] = -0.33 [-0.97 to 0.28], $p = 0.353$) and BMI z-score (-0.12 [-0.27 to 0.04], $p = 0.178$) were not statistically significant. However, there was a significant group-by-time interaction for percentage body fat (-1.96% [-3.02 to -0.89, $p = 0.006$]). Intervention effects for physical activity, screen-time and dietary intake were not statistically significant.

Conclusion: The NEAT Girls intervention did not result in significant effects on the primary outcome. Further study of youth who are 'at risk' of obesity should focus on strategies to improve retention and adherence in prevention programs.

Trial Registration: Australian New Zealand Clinical Trials Registry No:ACTRN1261000033004

1 BACKGROUND

2 Both the negative consequences of unhealthy weight gain,¹ and the high likelihood of pediatric
3 obesity tracking from childhood to adulthood,² highlight the importance of targeting youth who are
4 'at risk' of obesity. While there is evidence to support the beneficial effects of school-based child
5 obesity prevention interventions, few studies have assessed maintenance or sustainability of impact
6 after the initial post-test assessments.³ This paper presents the 24-month outcomes from the Nutrition
7 and Enjoyable Activity for Teen Girls (NEAT Girls) intervention. NEAT Girls was a 12-month
8 obesity prevention program targeting adolescent girls living in low-income communities.⁴ After 12-
9 months the intervention effects on body composition were not significant, but there was a significant
10 group-by-time interaction for reduced screen-time. The aim of this paper is to report the sustained
11 impact of the program on body composition and health behaviors.

12 METHODS

13 Study design and participants

14 The study design, methods and participant characteristics at baseline are reported in detail elsewhere.
15 ⁵ Briefly, the NEAT Girls intervention was evaluated using a group randomized controlled trial
16 (RCT) which included involving 12 secondary schools located in low-income communities in New
17 South Wales, Australia. Study participants were adolescent girls in Grade 8 at the time of
18 recruitment. Ethics approval for the study was obtained from the University of Newcastle, Australia
19 and the New South Wales Department of Education and Training Human Research Ethics
20 Committees. School principals, parents and study participants provided written informed consent.
21 The sample size calculation was based on change in body mass index (BMI). To detect a between
22 group difference of one BMI unit,⁶ 30 participants from each of the 12 schools were required. This
23 calculation was based on an alpha of 0.05 (two tailed), power of 80% and a drop-out rate of 20%.
24 Baseline assessments were carried out before randomization during May/June, 2010 (Figure 1). The
25 12-month (immediate post-program) assessments were completed during May/June in 2011 and these
26 outcomes have been reported.⁵ This paper reports the 24-month outcomes (May/June, 2012).

1 **Intervention**

2 The intervention was guided by Social Cognitive Theory⁷ and informed by the Program X pilot
 3 study.^{8,9} NEAT Girls⁴ combined a range of strategies to promote lifestyle (e.g. walking to school)
 4 and lifetime physical activity (e.g., resistance training), improve dietary intake and reduce sedentary
 5 behaviors. Intervention components included enhanced school sport sessions, lunchtime physical
 6 activity sessions, nutrition workshops, interactive educational seminars, pedometers for self-
 7 monitoring, student handbooks, parent newsletters, and text messages to reinforce and encourage
 8 targeted health behaviors.

9 **Outcome measures**

10 Data were collected at the study schools by trained research assistants. Group allocation to control or
 11 intervention treatment did not take place until after baseline assessments were conducted.

12 *Body Composition*

13 The primary outcome was BMI (weight [kg]/height [m]²). A portable digital scale (Model no. UC-
 14 321PC, A&D Company Ltd, Tokyo Japan) and a stadiometer (Model no. PE087, Mentone
 15 Educational Centre, Australia) were used to measure weight and height and BMI-z scores were
 16 calculated.¹⁰ The ImpTM SFB7 bioelectrical impedance analyzer¹¹ examined percentage body fat.

17 *Physical Activity*

18 Actigraph accelerometers (MTI models 7164, GT1M, GT3X) were used to collect physical activity
 19 data. Participants' data were included in the analyses if accelerometers were worn for ≥ 600 minutes
 20 per day for at least three days, including a weekend day. Mean counts per minute (CPM) and
 21 percentage of time in moderate-to-vigorous physical activity (MVPA) were calculated.

22 *Dietary Intake*

23 Dietary intake was assessed using the Australian Child and Adolescent Eating Survey (version 1.2).

24 ¹² Values for total kilojoules/day and total kilojoules/kilogram/day were reported.

1 *Sedentary Behavior*

2 Participants self-reported their screen-based sedentary behaviors using the Adolescent Sedentary
3 Activity Questionnaire.¹³

4 **Analysis**

5 Analyses followed the intention-to-treat principle and were conducted using linear mixed models.¹⁴
6 The mixed models were tested using the PROC MIXED statement in SAS V9.1 (SAS Institute Inc
7 Cary NC) and were adjusted for clustering at the school level. All statistical tests were two-tailed and
8 *p*-values were adjusted for multiple computations (critical *p*-value = 0.0063).

9 **RESULTS**

10 The study sample included 357 (*M*=13.2 years, *SD*=0.5) girls and at baseline, 27.9% and 16.2% of
11 the sample were overweight or obese, respectively. At the 24-month assessments, 114 (64.0%) and
12 123 (68.7%) girls were retained in the intervention and control groups (Figure 1). Changes in BMI
13 were not statistically significant (Table 1), but there was a statistically significant group-by-time
14 interaction effect for percentage body fat (-1.96%, *p*=0.006). The intervention group decreased their
15 screen-time and both groups decreased their physical activity and total daily energy intake over the
16 24-month study period. There were no significant group-by-effects for any of the health behaviors.

17 **DISCUSSION**

18 This paper reports the sustained impact of the NEAT Girls intervention on body composition and
19 health behaviors. After 24-months, the NEAT Girls intervention effect on the primary outcome
20 (BMI) was not significant, but there was a significant between group difference of almost 2% body
21 fat in favor of the intervention group. A difference of this magnitude may be considered clinically
22 significant. Evidence from recent longitudinal¹⁵ and experimental¹⁶ studies have demonstrated that
23 similar changes in body composition are associated with more favorable cholesterol and fasting
24 insulin levels in youth, respectively.

1 The absence of a statistically significant intervention effect on BMI and BMI z-score, despite
 2 significant improvements in body fatness is consistent with findings from previous obesity
 3 prevention studies in adolescents,^{17, 18} and highlight the challenges of accurately assessing body
 4 composition in youth. Currently, there is no consensus regarding the most appropriate measure for
 5 assessing change in obesity prevention studies. Cole and colleagues¹⁹ suggest BMI is the best
 6 measure of adiposity change in growing youth. Yet others have argued that BMI lacks the sensitivity
 7 to distinguish between fat and fat-free mass, and that alternate measures are more suitable for
 8 detecting change in body composition (e.g. skinfolds).^{17, 18}

9 After 24 months, there were no significant intervention effects for any of the behavioral outcomes.
 10 Although there was a significant between group difference of 30 minutes screen-time at the 12-month
 11 assessments,⁵ this difference was no longer significant in the 24-month follow-up analyses. It
 12 appears that the NEAT Girls intervention had a more favorable effect on sedentary behavior than
 13 physical activity or dietary behaviors. Interestingly, these results support findings from a review of
 14 behavioral interventions to prevent obesity in youth, which indicated that strategies to reduce
 15 unhealthy behaviors seem to be more effective than strategies to increase healthy behaviors.²⁰

16 The study strengths include the group RCT design, the unique study population and monitoring of
 17 intervention fidelity. Further, the inclusion of 24-month assessments provides evidence for the distal
 18 impact of the 12-month intervention. However, there are some limitations that should be noted,
 19 including the use of self-report measures to assess changes in screen-time and dietary behaviors, and
 20 poor accelerometer compliance. Finally, due to participant attrition, the analyses were underpowered
 21 to detect small changes in BMI. This combined with lack of measurement precision may have
 22 prevented us from detecting relatively large intervention effects in behavioral outcomes.

23 **Conclusion**

24 The NEAT Girls intervention resulted in statistically significant improvements in body fatness that
 25 may have clinical importance. Reductions in screen-time were also observed over the study period

1 which may have important implications for preventing unhealthy weight gain among adolescent girls
2 living in low-income communities. The current findings demonstrate the potential for multi-
3 component school-based interventions, but also highlight the need to identify strategies for retaining
4 participants in obesity prevention interventions, especially those from disadvantaged communities
5 which have transient populations.

1 ABBREVIATIONS

2 BMI – Body Mass Index

3 CI – Confidence Intervals

4 CPM – Counts Per Minute

5 CONSORT - Consolidated Standards of Reporting Trials

6 MVPA – Moderate-to-Vigorous Physical Activity

7 NEAT Girls – Nutrition and Enjoyable Activity for Teen Girls

8 RCT – Randomized Controlled Trial

9 SCT – Social Cognitive Theory

10

11

12 ACKNOWLEDGMENTS

13 This research project is funded by an Australian Research Council Discovery Project Grant

14 (DP1092646). This sponsor had no involvement in the design or implementation of this study, in

15 analyses of data, nor in the drafting of this manuscript. We would like to thank the Project Manager

16 Tara Finn and the following research assistants: Sarah Costigan, Rebecca Horton, Melanie Fagg,

17 Kayla Lawson and Xanne Janssen. We would also like to thank the schools, teachers and study

18 participants. Deborah L. Dewar is supported by an Australian Post Graduate Award scholarship and

19 Anthony D. Okely is supported by a National Heart Foundation of Australia Career Development

20 Fellowship (CR11S 6099).

21

22 The individuals personally identified in the acknowledgements have consented to their names being

23 communicated.

24

1 REFERENCES

- 2 1. Tsiros MD, Coates AM, Howe PR, Grimshaw PN, Buckley JD. Obesity: the new childhood
3 disability? *Obes Rev.* 2011;12(1):26-36.
- 4 2. Singh AS, Mulder C, Twisk JWR, van Mechelen W, Chinapaw MJM. Tracking of
5 childhood overweight into adulthood: A systematic review of the literature. *Obes Rev.*
6 2008;9 (5):474 - 488.
- 7 3. Waters E, de Silva-Sanigorski A, Hall BJ, et al. Interventions for preventing obesity in
8 children. *Cochrane Database Syst Rev.* 2011;12:CD001871.
- 9 4. Lubans DR, Morgan PJ, Dewar D, et al. The Nutrition and Enjoyable Activity for Teen
10 Girls (NEAT girls) randomized controlled trial for adolescent girls from disadvantaged
11 secondary schools: rationale, study protocol, and baseline results. *BMC Pub Health.*
12 2010;10:652.
- 13 5. Lubans DR, Morgan PJ, Okely AD, et al. Preventing obesity among adolescent girls: One-
14 year outcomes of the Nutrition and Enjoyable Activity for Teen Girls (NEAT Girls) cluster
15 randomized controlled trial. *Arch Pediatr Adolesc Med.* 2012;166(9):821-827.
- 16 6. Robinson TN, Kraemer HC, Matheson DM, et al. Stanford GEMS phase 2 obesity
17 prevention trial for low-income African-American girls: design and sample baseline
18 characteristics. *Contemp Clin Trials.* 2008;29(1):56-69.
- 19 7. Bandura A. *Social Foundations of Thought and Action: A Social Cognitive Theory.*
20 Englewood Cliffs, N.J: Prentice-Hall; 1986.
- 21 8. Lubans DR, Morgan PJ, Callister R, Collins CE. Effects of integrating pedometers, parental
22 materials, and email support within an extracurricular school sport intervention. *J Adolesc*
23 *Health.* 2009;44(2):176-183.
- 24 9. Lubans DR, Morgan PJ, Callister R, Collins CE, Plotnikoff RA. Exploring the mechanisms
25 of physical activity and dietary behavior change in the Program X intervention for
26 adolescents. *J Adolesc Health.* 2010;47(1):83-91.

- 1 10. Cole TJ, Bellizzi MC, Flegal KM, Dietz WH. Establishing a standard definition for child
2 overweight and obesity worldwide: international survey. *BMJ*. 2000;320(7244):1240-1243.
- 3 11. Lubans DR, Morgan PJ, Callister R, et al. Test-retest reliability of a battery of field-based
4 health-related fitness measures for adolescents. *J Sports Sci*. 2011;29(7):685-693.
- 5 12. Watson JF, Collins CE, Sibbritt DW, Dibley MJ, Garg ML. Reproducibility and
6 comparative validity of a food frequency questionnaire for Australian children and
7 adolescents. *Int J Behav Nutr Phys Act*. 2009;6:62.
- 8 13. Hardy LL, Booth ML, Okely AD. The reliability of the Adolescent Sedentary Activity
9 Questionnaire (ASAQ). *Prev Med*. 2007;45:71-74.
- 10 14. Mallinckrodt CH, Watkin JG, Molenberghs G, Carroll RJ, Lilly E. Choice of the primary
11 analysis in longitudinal clinical trials. *Pharm Stat*. 2004;3:161-169.
- 12 15. Dai S, Fulton JE, Harrist RB, Grunbaum JA, Steffen LN, Labarthe DR. Blood lipids in
13 children: age-related patterns and association with body-fat indices: Project HeartBeat! *Am*
14 *J Prev Med*. 2009;37(1 Suppl):S56-64.
- 15 16. Foster GD, Linder B, Baranowski T, et al. A school-based intervention for diabetes risk
16 reduction. *New Engl J Med*. 2010;363(5):443-453.
- 17 17. Singh AS, Chin A Paw MJM, Brug J, van Mechelen W. Dutch obesity intervention in
18 teenagers: effectiveness of a school-based program on body composition and behavior. *Arch*
19 *Pediatr Adolesc Med*. 2009;163(4):309-317.
- 20 18. McMurray RG, Harrell JS, Bangdiwala SI, Bradley CB, Deng S, Levine A. A school-based
21 intervention can reduce body fat and blood pressure in young adolescents. *J Adolesc Health*.
22 2002;31(2):125-132.
- 23 19. Cole TJ, Faith MS, Pietrobelli A, Heo M. What is the best measure of adiposity change in
24 growing children: BMI, BMI %, BMI z-score or BMI centile? *Eur J Clin Nutr*. 2005;59:419-
25 425.

- 1 20. Kamath CC, Vickers KS, Ehrlich A, et al. Clinical review: behavioral interventions to
2 prevent childhood obesity: a systematic review and meta-analyses of randomized trials. J
3 Clin Endocrinol Metab. 2008;93(12):4606-4615.
4
5
6
7

- 1 **List of titles for all figures**
- 2
- 3 Figure 1: Flow of Participants through the study